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Strategy processes in national research programmes – challenges and changes in the identity of science

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PART I: Introduction, background and tendencies
PART II: Two case studies

A range of STS analyses over the recent years show that the character and the societal identity of science and research are changing. Science and research activities are to an increasing and more explicit degree taking place in dialogue and interaction with their surroundings. To a larger extent than earlier, the scientific activities are influenced by societal and political issues. Moreover, knowledge production has got a increasingly strategic role in society and is considered the central driver of the knowledge society and the knowledge economy. The changes in the character and identity of science are significant on many levels, both at the level of research groups and scientific areas, at the level of research institutions, at the level of the single scientist, and at the level of public policy and governance of science. This text goes into the latter: It analyses and discusses strategy processes of national research programmes and the challenges these strategy activities are currently facing. The text reports a case-based study of national programmes.[1] The study identifies:

- what are the strategy development activities in the national research programmes?
- how are the strategy processes carried out – which methods and systematics are employed?
- who are involved – which are the actors?

Through this, the study analyses the understanding of science and technology development represented in the strategy processes of the national research programmes, the represented pictures of typical actor roles in connection with science and research, and the current challenges facing the programmes.

The study focuses on two Danish technology-oriented research programmes: The Energy Research Programme ('Energiforskningsprogrammet', EFP) and the programme of the Technical Research Council ('Statens Teknisk-Videnskabelige Forskningsråd, STVF). Before presentation of the single cases, the background and general aspects of governance of science and of research programmes as institutional interface between science and policy are described. Apart from the STS literature (social studies of Science, Technology, and Society), the approach of the text builds on the studies of research policy and governance and management of science. The text ends with a case 2½: a brief discussion of the perspectives of a new legislation of the research advisory and funding system coming into force in Denmark which goes across the two cases and which includes the definition of a 'strategic' part of the system and a 'non-strategic' part building on bottom-up suggestions from researchers.

By 'national research programmes' we here mean central national research funding functions and funding institutions with a specifically, whether broadly or narrowly, defined area of work. Examples of national research programmes are both strategic research programmes within specific resort areas and ministries and specific problem fields and sectors; and more general research councils connected to ministries of science and research. The study focus on the general and overall

[1] The study is funded by the Danish Social Science Research Council (SSF) and Risø National Laboratory.

strategies of the research programmes rather than the strategic aspects involved in, for instance, decision on funding of a single project within the programme or in, for that sake, the establishing of the programmes. These different strategy aspects are, of course, often interrelated.

Strategies and realities are two sides of the same coin. You cannot separate them from each other and they are deeply integrated in each other. This does not mean that it is impossible, as we do here, to focus on the strategic aspects and strategy processes, but it means that you will have to consider the situation and contexts of the strategies and the subject areas it is *strategies for* when carrying out the study. Approaches that make a clear cut between strategic aspects and non-strategic aspects are of limited value. For normative suggestions and recommendations, it also means that you cannot just directly copy approaches from one area to another.

Research programmes between research and politics

Though national research programmes in many countries account for a smaller amount of the total research funding compared to funding through universities' and research institutions' basic resources and compared to the funding from companies, national research programmes play quite an important role for the development of science and research. In Denmark approximately 20-25% of public research is funded through research programmes (Forskningsstyrelsen 2003, pp. 9-11).

National research programmes often channel money to new and important emerging research areas and topics. Through this, they contribute to changes and development of new directions for research institutions and for the research community in general. The strategies and micro-politics of research programmes can thus have a central role, in some cases a pivotal role, in the broader strategies and developments of science and research systems. To manage national research programmes is a highly important part of science governance and research management in general.

The dynamics that the programmes induce are at another pace and cadence than the structural institution dynamics and development patterns of universities. By being a second string of research funding in addition to the national basic funding of the research institutions, the research programmes contribute to a kind of competition within the research system. The competition is not only between institutions, but also between individual researchers, research areas and approaches. At the same time, research councils and other national research programmes can be an important arena for co-ordination and formulation of common views between researchers and institutions.

The general aspects of national programmes mentioned here are supported both by the case studies and by the existing literature on the subject (see below). National research programmes are influenced by national policy. Not only are the programmes by their definition created through governmental decisions and prescriptions. They are often also in frequent contact and interaction with national policies of research as well as policies of other areas. This happens, for example, through reporting on the activities and developments in the areas they deal with, through communication about new state budget proposals and new important areas of research. Much of the interaction happens through the ministries and the administrative-regulatory system there.

Practice and steering activities in national research programmes also reflect and are influenced by the research fields and areas of work of the programmes. With the position in central national administration, strategy processes in national research programmes thus appear under the influence of both current tendencies in general policy practices and norms and current understandings and change trends in connection with science and research. The programmes mediate between national politics and the programme areas and their institutions.

In this mediating arena between politics and research, the managers of the research programmes are in a situation where they must secure appropriate strategy development for the programme. They shall address questions on how the subject area of the programme shall be described and understood and which means and measures are needed to develop the programme or to, at least, secure the programme's cohesion and existence. The programme managers have to consider which information and experience areas that shall be employed to develop the strategies, who shall be involved in the strategy processes, and which methods and approaches for the strategy developments that are practically feasible, appropriate as well as fair and suitable in consideration of the programme's definition and position and of the related parties. This also includes questions on how legitimacy and accountability for the programme is supported and considerations of which interests and needs that shall be satisfied, for example, in order to maintain support for the programme.

The strategy processes in national research programmes reflect the influences from the surroundings of the programmes, not only in the sense that they reflect specific topics of current interest in Government, research communities, etc. They also reflect the broader discourses and norms about the character of science and its role in society. With their central position in national research policy and research management, national research programmes are a place where discussions of the social contract for science and research, as it metaphorically has been coined (Guston 1994), take place. Also, the societal role of research and the identity and position of science in society are negotiated in the strategy developments. With the close connection to politics and the central position in general, the aspects of the current changes in the identity and societal role of science and research can in many cases appear explicit and very distinct in the interaction in and around national research programmes. For example, aspects of the societal demand for research cf. the Mode 1 – Mode 2 discussions (Gibbons et.al. 1994) are often clearly pinned out.

What is interesting about studying strategy processes of national research programmes in the perspective of the changing role and identity of science in society, is not least which typical actor roles that are inscribed in the strategies and, especially, what picture of the role and character of science that is present. The represented understandings of knowledge development processes and the understandings of technology development and technology areas are also important and central issues.

In the study behind this paper, we focus on technology-oriented research programmes (techno-scientific programmes), i.e., programmes in which technology development is one of the most central elements. With this delimitation of the project, we are lucky to be involved with a mainstream part of science and research and with one of the parts that is explicitly discussed and highlighted in the research political discussions, in the media coverage and in public discussions of science, universities, etc. Influential and dominating policy issues such as 'innovation' and 'public-private collaboration' are directly addressing technology-oriented research, as development of new technology is a very central element in these, whether being implicit or explicit. The connection between the dominating research policy themes and other research branches, e.g., social science and humanities is unclear and often hard to find. The same can to some extent be said to be the case for concepts within current studies of research management, governance, and policy such as the triple helix concept, public-private partnership, and entrepreneurship. This is, however, partly due to a lack of alternative formulations from social science, humanities, etc., about the character of research management and governance activities.

A governance perspective on science and research management

As it is the point in the recent years' governance literature, the strategies and plans of national research programmes occur not as a governmental dictate or as autonomous processes detached

from governmental influence, but are developed in interaction between governmental authorities and policies and actors in the covered activity areas. This is also described in governance literature on science and research specifically (Hackmann 2001a+b, Fuller 2000, Glynn et.al. 2001, Fèron & Crowley 2002, Goncalves 2003) as in the more general governance literature that often emphasise the connection between types of governance approaches and the issue of democracy (March & Olsen 1995, Pierre 2000, Hirst 2000). The question is not if there is interaction between Government actors and actors relevant for the research areas to be managed, but which actor groups and networks are included in the processes, and which are excluded. It is a question on how, in which interaction processes and with which weight the different actors are represented and involved in the processes.

The 'new' governance approaches is governance in and by networks of actors. They focus on interaction and co-ordination between actors instead of having a hierarchical view on governance. And they emphasise the importance of decentralised activities and the interplay between centralised and decentralised steering. With this network and social co-ordination perspective, governance studies are in accordance with the knowledge in the field of social studies of science, technology and society dynamics (STS). These studies have documented that heterogeneity and a complex and thorough mutual integration of social and technical matters, of human and natural matters, are general characteristics of science and research in the present society. The construction of new research areas and new knowledge and technology occur in interactions between heterogeneous sets of actors (not homogeneous sets of actors, e.g., not only through scientists within a well-defined area of work) and through a heterogeneous diversity of different complex dynamics (Law 1991, Bijker & Law 1992, Latour 1993). Scientific activities and knowledge are situated and influenced by the specific context (Haraway 1991, Pickering 1992, Collins 1985). The change processes have co-shaping and network character with complex and continuous discussion, experimentation and negotiations between actors (Callon 1999). This is why it can be said that research steering is distributed. There is a mutual shaping of new institutional actors, power structures, and networks and new knowledge and technology.

In recent years, the classical social science principal-agent theory has shown fruitful in studies of governance of science and research, especially in studies on research programmes and funding functions (Braun 1993, Guston 2000, van der Meulen 1998). Of course, there are compared to the STS studies and the governance studies limitations to this approach, given the highly simplified picture of the situation, actor set-up, etc., the model with a principal and an agent offers, which does not capture the complexity and heterogeneity of research development. However, the approach throws light on the important central relation between Government and research management and the delegation of tasks and competences by the Government to research councils and research programmes prescribed in formal rules and law texts.

The principal-agent studies points to the importance of boundary organisations between Government and research and the central role these to some extent independent organisations play in the management and development of research. The way these boundary or intermediary organisations are structured and institutionalised is very influential on the development of science and research areas as part of society. The way the boundary organisations act and the communication and information flows in and around them are of critical importance. The constantly renegotiated relationship between research and Government to a considerable extent occurs in connection with the activities of these organisations.

The limitations of the principal-agent approach are clear, not least when it is questioned: Who is the principal and who is the agent? In some respects you might as well consider the situation in governance of science the other way around: that science policy and the national governance of science shall serve science and make the best possible frame for science. This is also relevant in connection with national research programmes. In practice, the research actors do not consider

themselves as primarily being in an agent role for the Government. The understanding that science is a grass root activity, which shall be facilitated by the public and the national governance rather than being steered, is an understanding you often meet. Another limitation of the principal-agent model is the unequal distribution of information pre-supposed in the model. This is not as one-dimensional as the model suggests with simply more knowledge about the field at the agent than at the principal. The information differences go along many different dimensions and are to a considerable extent a question of different perspectives.

Research processes and production of new knowledge are increasingly influenced by their surroundings and by societal demands. At the same time, science and knowledge production are getting a more central and strategical role in society and are by many considered the central driver of development and economy. This is captured in the term knowledge society (Knorr-Cetina 1999). The increased focus on the strategic role of science, knowledge and knowledge intensive technology also means that there is more attention to the strategies of research programmes. In general, research is to an increasing degree seen as an object of steering and management. In this also actors from outside science can be involved. In connection with this, new discussions of rationales, legitimation and transparency of the strategy processes have emerged.

It is widely recognised among actors involved in management of research programmes, that research and research institutions to a much higher degree than earlier, also compared to just 10 years ago, are under pressure for showing the relevance and societal use of their research and need to consider these aspects in their activities. The pressure on research and on research programmes to be able to satisfy societal demand is higher than earlier. This is in accordance with the Mode 2 – Mode 1 discussion of research.

It is at the same time recognised that the pace in research activities is considerably higher than it was earlier and that the speed of change has gone up. We live in a change-oriented culture, where tomorrow and the ability to define what tomorrow will bring receives more and more attention. Change and development (rather than continuity, stability, and tradition) are central and powerful elements in the set of values and norms within science and technology-oriented research (van Lente 1993, Brown et.al. 2000).

The emergence of the research programme instrument

The institutionalisation of national research programmes is one of the later developments of the research systems. Over the second half of the 20th century, research systems have grown and become significantly more complex. While the institutionalisation and funding of public research prior to World War II by and large consisted solely in universities and other higher educational institutions and the basic governmental funding of these institutions, the number of types of institutions and funding functions has increased considerably thereafter (Grønbæk 2001).[2]

The research councils were created in the period up until the late 1960's. In Denmark, the research council system was established in 1968, though the first council, the Technical Research Council (STVF), already appeared in 1946, however, during the first years without the same role as governmental funding institution as later. It was one of the reasons for establishing research councils, originally, in the western countries to ensure that direction, prioritisation and goal-setting of research were not only a matter of internal institutional strategies and prioritisation, but that some coordination across research institutions was happening and that influence from outside science on

[2] For overviews of the developments in the institutionalisation and governance of research systems, see, for example, (Hansen 1996, Aagaard 2000, Grønbæk 2001, Guston 2000, Benner 2001). The first three focus on Danish developments, Guston on USA, and Benner on Sweden.

the direction and goal-setting of research was possible. Development of research should not only be a matter of internal institutional policy at the universities (Foss Hansen 1996, Aagaard 2000, Guston 2000).

Research was increasingly considered an important element in the development of the welfare society and its economic growth. The role of research and innovation for societal development were promoted, for example, by supranational organisations such as OECD. During not least the 1970's, different ministries created a number of new public research institutions working specifically in areas of relevance to the working area of the ministry ('sector research'). In addition to the direct basic funding of the universities, the funding function of the research councils and the individual ministries were now also important parts of the total research funding.

The institutional instrument of strategic research programmes occurred as an important element in the research governance and policy in many countries during the 1980's (in Denmark, primarily from the mid-1980's and onwards). Through the strategic research programmes were specific research and technology areas, problem fields and goals pointed out as research issues from national policy level (Aagaard 2000, Ståhle 1992).

The Danish Energy Research Programme is in this connection an exception to the general picture as it was established already in 1976, not least as a reaction to the oil crisis. Other research programmes such as the technology-oriented TUP (The Technological Development Programme), BIOTEK (The Biotechnological Research and Development Programme) FØTEK (The Food Technology Research and Development Programme) were established between 1985 and 1990 (Floris & Rieper 1995). The establishment of the strategic research programmes can in many cases be seen as a prioritisation of research areas related to industrial policy and development (Jensen 1996).

Some strategic programmes have been administered by the resort ministries, e.g., EFP (in the Ministry of Energy, now in the Ministry of Economic and Business Affairs) and TUP (in the Industry & Trade Agency under the Ministry of Industry) and other programmes by the research councils, e.g., BIOTEK. In many cases, a cross-institutional co-ordination or background committee was also involved.

The research councils also became more 'strategic' during that period, which can be called the strategic turn in national research management. In 1987, it was incorporated in the regulations for the Danish research councils that a part of their task was to describe strategy plans for their working area. The obligation to define strategy plans was another means of securing strategic prioritisation and co-ordination across the individual research topics and research institutions (Aagaard 2000 p. 61). With a report on the state of and perspectives for the technoscientific research ("Teknisk-videnskabelig forskning: Status og perspektiver") published in 1983, the Technical Research Council was the first council to develop a strategy plan (Grønbek 2001, p. 101). In the governmental regulation text prevailing from 1997 up until the present day, the obligation to make strategies is stated as follows:

"The national research councils' tasks in connection with the support of Danish research include: ... ...2) A strategy function, where the councils produce strategy plans that can lead to research council initiatives or to strategic programmes, which can be established by relevant ministries."[3]

The strategy plans produced by the research councils are five-year plans. The annual one-year plans that are used not least as input to the state budget negotiations within the Government and

[3] The Danish Minister of Research, Jytte Hilden, LBK nr. 676 af 19/08/1997 Bekendtgørelse af lov om forskningsrådgivning mv., § 4b (my translation)

the Parliament are by many of the involved actors considered at least as important. They can, for example, play a role in connection with initiation of new strategic research programmes. The one-year plans are usually co-ordinated with the five-year plans.

Research policy has together with the occurrence of the knowledge society over the last decades grown in many countries. Research policy is becoming more and more explicit and pronounced. Science is now something that shall be governed like many other societal issues. The research ministry in Denmark has over a 15-year period developed from being a new and small ministry with a few tasks and relatively little influence to an important and influential ministry visible in the general national policy and on some issues with a co-ordinating and leading role for other ministries. After 5 - 10 years of debate and organisational experiments, new basic laws concerning the universities and the research advisory and funding system were in the Spring of 2003 decided upon. The adoption of these new laws can be seen as the culmination so far of the power of the research policy and the research ministry. The name of the ministry is currently the Ministry of Science, Technology and Innovation.

It has for a long time been normal to look to other countries and the way they constitute their public governance institutions when changes in the structure and institutional set-up are to be made (Foss Hansen 2000 and 1996). The Ministries of Research have in this way developed in parallel in many European countries. However, it turns out that the specific constitutions of the institutions in the different countries are, although similar at a first glance, often very much of local character and influenced by the specific political and cultural context.

Industry-orientation and Europeisation

Apart from the above-mentioned general tendencies of knowledge society, strategic turn, network governance, etc., managers of national research programmes are currently facing a number of other specific challenges and trends that will influence the practice and strategies of the research programme management over the coming years. One of them is the business and industry orientation of public research and universities. This development is not exactly new as there have also in the late 1970's and the 1980's been called for increased industry-university collaboration, not least in the technology-oriented areas. The tendency has, however, also in the latest years been enforced and strengthened in research policy and debates on the topic. The new Danish university law includes the business and industry representation in the Boards of the universities and is but one of the recent examples of the direction of public research towards business and industry.

The business and industry orientation has been increasingly routinised over the last 25 years and is to a larger and larger extent seen as a norm for public research activities. It has to a considerable extent become a part of the identity of techno-scientific activities. The role for science in this techno-economical world order is to be suppliers to industry and through this contribute to the economical growth of society cf., e.g., the recent action plan by the Danish Government 'From thought to invoice' ('Fra tanke til faktura'). This discourse builds to a large extent on the understanding and metaphors of the 'linear model' of development going from a scientific idea over technology and innovation to diffusion and industrial production and consumption. This model is not supported by studies of science and technology dynamics or studies of the dynamics of knowledge society.

One of the other important current trends in the management of the research programmes is the Europeisation. The increasing importance of the European Union in societal development, legislation work, policies, trade and production in general is a phenomenon that might significantly influence the strategies of national programmes. There is an increase in transnational relations and networks, reflected in terms such as globalisation and internationalisation, and the role of the national state is diminishing. With the European research programmes and the thoughts about a

European research area and European Research Council, the national research programmes are now in a situation where another level of research funding and research co-ordination has occurred. This is not least significant in the technology-oriented areas. The programmes and the national research governance are in general currently developing practices that can handle this and co-ordinate the national efforts with the European. The increasing dominance of English language is also a part of the general Europeisation and the cross-national harmonisation that is happening. In science and research, however, English has for a long time been one of the most used common languages.

PART II: Cases

The following section describes the two studies cases and the main aspects of their strategy processes.

Strategy processes in the Technical Research Council (STVF)

As one of the six traditional research councils in Denmark, the Danish Technical Research Council has the last 15-20 years had the development of five-year strategy plans as one of its activities. The annually input to the national budget negotiations, which is another strategic aspect in the research council's activities, is coordinated with the five-years plans. The 15 members of the Technical Research Council are researchers, primarily from universities. The council is located in the Danish Research Agency under the Ministry of Science, Technology and Innovation as are the other parts of the 'research advisory system'. The amount of research money managed by the Technical Research Council is in the order of 100 million DKK per year plus usually, in most years, a limited number of special programme appropriations in the national budget targeted specifically at issues defined in the budget.

The latest strategy plan for the Technical Research Council is Strategy Plan 2003-2007 published in August 2002. The development of this research plan turned out to consist in three main phases:

1. Visions papers development
2. Definition of strategic efforts ('strategiske satsninger')
3. Elaboration of communication format

The actors involved in the interaction on the development of the plan were primarily the research council members and the employees of the Research Agency. Large parts of the interactions, including the decisions on how to advance in the process, consisted in internal discussions within the council. The Chairman and a working group, also including a couple of other members, were the council members who carried out much of the work.

However, a number of Danish technoscientific researchers outside the council were asked in the first phase to write papers about their visions on developments in their research areas as input to the strategy process. The vision papers should all cover all the different areas within techno-scientific research. The authors, who not only came primarily from public research institutions, but also from private enterprises, were handpicked by the council as experienced, visionary persons, also able to describe broader, cross-disciplinary thoughts about development of the research. Approximately 45 vision papers were submitted.

The council members described and discussed during the second half of 2001, the different areas of techno-scientific research, building on, among other things, the vision papers. On the basis of

this, 7 strategic areas were defined for the strategy plan. The strategic areas can to some extent be seen as a representation of main areas of techno-scientific research, so that the complete field is covered all in all, integrated with specific current topics and relevant perspectives.

The strategy processes that are considered by many of the actors most important during that period are, however, a parallel discussion about a new measure to be employed in the council's funding function. Through these discussions, 'research consortia' is defined as a type of funding in addition to the existing instruments such as engineering research centres, framework programmes, and talent projects. The research consortia instrument is a reaction to the demand for improved collaboration of public and private research. In the definition of a research consortium, openness and public access to the result of the research collaboration are emphasised and a number of companies (not only one) must be involved. The resort consortia instrument is included in the list of strategy areas for the strategy plan. The 8 areas are:

1. Biotechnology and Chemistry
2. Energy
3. Environment
4. Nanotechnology
5. Production and materials-technology
6. Information systems
7. Simulation
8. Research consortia

The third phase of the development of the Strategy Plan 2003-2007 gets a more important role for the final result of the strategy work than is possibly suggested by the term communication format. Though it from the beginning of the process was clear for many of the persons involved from the council and the research agency that the Strategy Plan would be simpler than the previous five-year plan (1998 – 2002), a final decision on making the Strategy Plan in a quite brief and politician targeted format was first made in the first months of 2002. The decision has created discussion in the research council and, later, among researchers in the broader Danish techno-scientific community.

The research agency played, in collaboration with the council, an important role in the definition of this communication format. The agency elaborated a template for a handy, clear and appetising colour layout, which they encouraged all the research councils to follow (only the Medical Research Council resisted the brief format). The Strategy Plan ended up being a publication of 28 pages with many pictures, brief texts, and boxes with short examples of the use of techno-scientific research and statement quotes from well-known and high-level industry representatives. This shall be compared with the approximately 100 full text pages of the Strategy Plan 1998 - 2002. A layouter and a PR company were hired to go into the work with the finalisation of the publication.

Compared to the earlier five-year plans, Strategy Plan 2003–2007 is aimed primarily at politicians, trying to convince them to contribute more money to the techno-scientific area. While the earlier plan focused on the 'internal' prioritisation and strategic action in the research council and on the different sub-areas within the main areas of techno-scientific research, the plan for 2003-2007 emphasises the societal importance of techno-scientific research; that techno-scientific research makes a difference for society.

The development of earlier strategy plans as well as strategy plans of other research councils, e.g., the Natural Science Research Councils, have employed broader hearings in the strategy development process. A mediating and coordinating role for the 2003 – 2007 plan within the research community as well as internally in the research council is not expected. In practice, there are indications that the Strategy Plan has at least to some extent, however, a co-ordination and direction-

giving effect on the research community. More concrete initiatives, or action plans, from the research council following the strategy plan are not expected for the time being. Apart from the actors mentioned above - the research council members, the agency employees, the PR company and the vision paper authors - only a few other persons have been directly involved in the development of the Strategy Plan 2003-2007.

Many different rationales for the strategies are present in the processes. The figure below lists the different rationales for the strategies' functions represented (for both two cases in our study). Usually more than one rationale is occurring at the same time and in within the single programme. Though one can be dominating for a longer or shorter period of time, they do not always directly exclude each other. The list is tentative.

Figure 1 Rationales of strategy functions (tentative list):

The strategy of covering all existing research areas
- supporting existing areas

The strategy of more money
- getting attention to research; by showing its societal importance

The strategy of no strategy
The strategy of strength areas
The strategy of co-ordination
The strategy of gaps and weak points
The strategy of (techno-scientific) territory
- demarcation, e.g. against natural science and the natural science research council

The strategy of new technologies
The strategy of developing new production and consumption systems
The strategy of serving industry

The actors involved in the strategy development of the Technical Research Council are listed in the middle column in the following table. The different roles of the actors and the different degrees of influence in the strategy development processes are indicated through the distinction between the core group of the strategy processes, the 'other actors' (involved to a smaller degree) and the target actors of the strategy plans. By the core group we here mean the group of actors steering the strategy processes and having significant influence on the agenda setting and structuring of the processes as well as the results. The target actors are the intended users of the strategy plans.

FIGURE 2: Actors

	STVF – Technical Research Council	**EFP – Energy Research Programme**
Programme management	- Council - Research Agency (secretariat)	- Energy Authority
Core group in strategy processes	- Council - Research Agency (secretariat + strategy and information functions)	- Energy Agency - System operators (PSO actors) - Consultants
Other actors in strategy processes	- Scientists - Communication consultants - Ministry/Minister - ((DI – Industry interests organisation))	- Advisory Council for Energy Research - Energy production companies and system operators - Energy technology companies - Scientists - (NGOs)
Target groups	- Government, Minister, Parliament politicians - (secundarily: scientists)	- Programme management - System operators - Energy production companies - Energy technology companies - Scientists
Number of actors	Limited	Many
Proportions of the strategy work	Limited	Extensive

Strategy processes in the Energy Research Programme (EFP)

The Danish Energy Research Programme is managed by the Danish Energy Authority, which is part of the Ministry of Economic and Business Affairs. The research programme is traditionally considered a strategic programme and is closely connected to Danish energy policy and government. The programme strategies are co-ordinated with the general governmental plans on energy issues and sometimes also on other issues e.g. the general national research strategy developed in the mid-1990's (Miljø- og Energiministeriet 1995 and 1996).

The Energy Research Programme experiences considerable turbulence in these years, following the change in the Government in 2001. The program is reduced from approximately 100 million DKK a year to less than half (40 million DKK in 2003), but it is expected to be approximately 70 million DKK in 2004 (Miljø- og Energiministeriet 1999 and Energistyrelsen 2003b). Together with major changes also in general in the Energy Authority and its' ministerial location, this turbulence has major influence on the strategy activities of the programme. Even more clearly than in the first case, it is obvious that you cannot understand the strategy developments separately from the other activities in and around the research programme. The contents and the context are closely interrelated. The case study focuses on the round of EFP strategy development in the period after 2001.

As indicated in Figure 1, the core group for the strategy development processes apart from the program management staff in the Energy Authority consists in representatives from the planning & development departments of the two energy systems operators in Denmark, Eltra and Elkraft System.[4] In addition, a number of consultants are involved, primarily on individual selected priority areas within the energy field. How this core group comes about is described in the following.

While the Energy Research Programme experience cut downs and there for a period is uncertainty about its' future existence, another funding programme for energy research, the 'PSO programme', is gaining importance. (PSO stands for Public Service Obligation.) Since its establishment in the late 1990s an increasing amount of money is channeled through this programme. With a budget of around 100 million DKK a year (130 million in 2005) it is now larger than the Energy Research Programme.[5] The PSO programme is defined as supporting research and development on environment-friendly energy production technologies. The managers of the PSO programme are the two energy system operators, but the Minister, and thereby the Energy Authority, has the general and overall responsibility and shall approve the areas prioritized in the programme.

The Energy Research Programme is no longer the most or the only important funding programme for research and development in the energy area. In this situation, the Energy Authority sees a renewed and changed need for strategy development on energy research. The PSO responsible system operators agree that a coordination of the strategies for the different programmes would be useful and contribute to an efficient allocation of the funding resource. A close collaboration and integration is established for the strategy development. The coordination and consensus making on strategies for funding of energy research goes further than the two mentioned programmes and efforts are made to make other sources of funding follow and support the common strategy development and coordination of Danish energy research and development (one of the other sources is the Technical Research Council and its' renewable energy funding.) However, only the PSO responsible institutions become part of the core group for the strategy processes defining and leading the activities. Information dissemination, coordination of decisions on which project applications to fund as well as other administrative activities are also a part of the close collaboration. Joint information meetings and a common internet portal for energy research funding is established in 2003.

The strategy development is thus located between the programmes rather than directly connected to the single programme. The programme managers and the institutions involved in the core group subscribe to and feel committed to the common strategies developed. And the programmes are to a considerable extent integrated. The location of the strategies between the programmes however also means that there is room for a certain amount of other activities in the individual programme than exactly those defined in the strategies.

[4] Following a governmental decision Eltra and Elkraft will merge next year and become EnergiNet Danmark.
[5] Also another PSO funding programme is represented in the strategy processes, namely the energy efficiency PSO, managed by the association of energy production companies, ELFOR. However, ELFOR has a smaller influence than the energy systems operators.

The Advisory Council for Energy Research (Det Rådgivende Energiforskningsudvalg, REFU) is an advisory board for the Energy Agency and Government. Its members are primarily (high-level) representatives from industry and research. In some periods the role of the board has primarily been to comment on and give suggestions to the work of the Energy Authority on the governance of the energy research. Thereby it contributes to among other things the legitimation of the activities. Since the beginning of the turbulent period, the role of the Advisory Council has however been a bit different, more dealing with the overall and general perspectives for energy research. During the first year of the turbulent period, the Advisory Council described in their own name a recommendation for a strategy (REFU 2002). Though listened to, the Government did not approve this suggestion of a strategy. This recommendation focuses on the importance of development of energy technologies. This is a focus that can be found in later parts of the strategy processes.

Given the smaller total budget for the Energy Research Programme, it is decided that the strategy development from early in 2003 shall concentrate on four areas:

1. Biomass energy
2. Solar cells
3. Wind energy
4. Fuel cells

This definition and decision on these priority areas are made by the Energy Agency and its officials in collaboration with the PSO actors. The selection of areas reflects the focus on environment-friendly energy production technologies in the PSO programme. The selection of only four priority areas results in a stronger technology focus than in the earlier programme strategies. The four areas is a narrowing down from a broader set of headlines and priority areas earlier in the strategies of the Energy Research Programme. In the years before, the list of priority areas appeared this way (with smaller changes from one year to another, IEA 1999 and Energistyrelsen 2002b):

1. Oil and gas
2. Biomass
3. Production of electricity and heat
4. Wind energy
5. Energy consumption in buildings and solar energy
6. Advanced energy technologies (fuel cells, super conductors, etc.)
7. Electricity savings and electricity efficiency
8. Energy and society
9. Industrial processes and products

Earlier standing advisory committees for each of the priority areas existed with members from the industry and research institutions working in the area. The committees played an essential role for the programme and provided input and background papers to strategy developments (IEA 1999). These committees are closed down.

In stead the core group leads the strategy work in the four areas supported by a few, experienced consultants on the individual areas. A template for the strategy development on the four areas is developed. It consists in these steps:

1. Analysis of the state of affairs in the area; leading to draft proposal of a strategy plan
2. Discussion of the proposal with the actors of the area at hearing meeting
3. Strategy plan in final version
4. Plan for specific actions and follow-up activities – road maps etc.

Steps 1 to 3 were carried out in 2003 and first half of 2004, while the follow-up activities and the road maps for some of the areas are undertaken currently. The strategy work was used in the funding decisions of the research programmes already in 2003. In the second half of 2003 and in 2004, a couple of other areas were defined as priority areas for strategy development. Firstly work on hydrogen technology was initiated. (This area is connected to the fuel cells area.) Secondly, strategy activities concerning energy-efficient technologies and bio fuels are going on in the energy agency. The precise connection of the latter to the Energy Research Programme is not clarified.

It is in general the intention by the programme managers and the core group of the strategy activities to be in interaction with the actors of the energy area. It is to a considerable extent fair to talk about an energy community in Denmark and the core group members know many of the actors in the area. There is a relatively strong network between the programme management and the established industrial actors and research actors in the energy technology field. In this sense, the strategy processes of the energy research programme correspond to the interaction perspective in the governance literature and to the Mode 2 model of research. Demands for the research are inscribed in the strategies primarily through the energy systems' actors, the industrial actors and through governmental policy. Considerable parts of the connections to the industrial and energy system actors have lasted for long time and are relatively strong and stable. It can, therefore, at least in some respects, be said that there is a partnership between government and the established industry and research institutions in connection with the energy research programme. In the fuel cell area, the partnership is even closer, as parts of the strategies are not public but only known by the involved parties. Two separate road maps for each of the two research-industry collaborations have been described. The close collaboration between research institutions and industrial companies in this area is encouraged by the managers of the Energy Research Programme. The closed character of the fuel cells plans is in opposition to the otherwise relatively openness of the energy research strategy developments in other areas.

There is presently a call from different actors, among others the energy systems operators, for a new general and comprehensive strategy for Danish energy research (e.g., Eltra 2003). That would be to raise the strategies from the level of the research programmes to the level of governmental policy.

FIGURE 3: Approaches and methods

	STVF – Technical Research Council	**EFP – Energy Research Programme**
Method systematics and tools	- Vision papers - Council discussions - Council members own descriptions of strategy effort areas - Communication, PR, and layout techniques: short and appetising	- Priority areas - Coordination with other funding programmes and with energy policy - Analysis of areas (present state and actor views) - Hearings and interactions with energy actors - Partnership - Network support and development - Strategy plans, road maps and follow-up activities with actors
Closed – open	Closed, mostly	Partly open
Participatory	A little	Partly
Transparency in process	No	Partly
Democracy appropriate	?	?
Legitimation, ensuring of	- Given from the outset (?) - Minister contact - Quotation of known industry leaders etc.	- Actor dialogues, partnership, consensus seeking - Advisory Council for Energy Research

The strategic work of the management of the national research programmes is not always devoted to pointing out priority research areas and describing plans for exploration of them, but can have many other purposes and functions. Only some of them have been mentioned above. Below is a tentative list of the functions identified in the Danish Energy Research Programme and the Technical Research Council.

FIGURE 4: Assumptions and understandings of research and typical roles

	STVF – Technical Research Council	**EFP – Energy Research Programme**
Research understanding	- Science as a field (independent societal sector - which must be maintained and requires support) - Research as basic foundation for societal growth and welfare (the techno-economical system) - Broad, general knowledge and competence basis – or niches and strength areas	- Research & Development – with emphasis on development - Research as the servant of development of the energy area and its industries

Object of the strategy activities	- Technoscientific research area as such
	- Sub-areas: science areas and science based or science supported technology areas (emerging)
	- The meeting point between science, technology use, and industrial commercialisation
		- Application area of energy research:
		  - Danish energy system
		  - Danish energy policy
		- Gaps and lacunas in knowledge and techniques on important energy areas, primarily new energy technologies
		- Make the actors play together and complement each other

Typical roles and elements	- Researchers with unique ideas - With the highest quality of research - The supreme methods	- Developers in specific energy (technology) areas - Analysts on the identified lacunas - Application experiments and demonstration/test of new technologies

Change in legislation and new co-ordinations

The management of Danish national research programmes faces in 2004 new challenges and the conditions for strategy processes in the programmes are changed on important points. Following the new law about the research advisory and funding system, the system now consists of the Research Policy Advisory Council, the Strategic Research Council and the so-called Free Research Council.[6] Within the latter, a number of 'professional research councils' ('faglige forskningsråd') shall defined, c.f., e.g., the Technical Research Council up until the present day. In the new law, there is no obligation for the Professional Research Councils to formulate strategy plans. Whether or not an explicit strategy plan, research programme management contains strategic aspects and de-facto strategies will exist. The strategic processes will not least consist in the definition of the funding practice and the instruments. The definition of the Councils' business procedures will also be of strategic importance.

The new law emphasises open competition for national research money granted through programmes, etc., and that scientific-based ('forskningsfaglig') quality assessment shall be carried out before decisions of funding are made. The Strategic Research Council shall deal with thematically delimited and politically prioritised research areas. It shall approve the funding procedures of other ministries' research programmes such as the Energy Research Programme, and it shall do scientific ('forskningsfaglige') assessments of the applications within these programmes. It is obvious that a lot of co-ordination is needed to make this process work. The Strategic Research Council shall look for new research tendencies and can in interaction with the Parliament start new initiatives. However, it is, despite the name, not the Strategic Research Council, but the Research Policy Advisory Council that shall explicitly deal with strategic aspects of the national research governance, initiation of larger new research initiatives, as well as development of the general national research strategy.

A trial balloon for the new conditions of management of national research programmes has been the strategic co-ordination of the management in the energy research area that has taken place in the last year. The applications for the Energy Research Programme are now also, following the intentions of the new law, evaluated in the Technical Research Council and not only in the programme management in the Danish Energy Authority. However, the co-ordination goes further than that and has other reasons than the new law, for example, the mentioned turbulence in the governmental support of energy research. It is a strategical attempt to make the different research funding sources in the energy area work together. Energy research funding, apart from the Energy Research Programme and the energy research funding from the Technological Research Council, also comes from, for example, the governmental renewable energy programme and the so-called 'PSO' money managed by the energy systems operators. A co-ordination group with representatives of the different energy research programmes, etc., carries out the strategic management and co-ordination in the energy area.

That it is the Technical Research Council that in practice carries out the scientific quality assessment of the applications in the Energy Research Programmes can be seen as yet another contribution in the direction of defining the energy research programme as primarily a technology research programme. Observers in the system expect that the new regulation will result in a number of new national research programmes defined in connection with the parliamentary state budget negotiations. It is still an open question whether the so-called arm's length principle will be realised effectively. Whether the attempt to constitute an organisational border between strategic and non-strategic research, i.e., between on the one hand thematically delimited and politically prioritised

[6] Ministry of Science, Technology and Innovation 2003: Lov om forskningsrådgivning m.v., L142, approved by Parliament 22 May, 2003. The law also defines a 'co-ordination board' to co-ordinate between the councils a.o.

areas and on the other hand a researcher-initiated research, is practically feasible and not too bureaucratic, is also an open question.

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